We claim:

1. A method for injecting fuel into a transient exhaust stream of an exhaust system, the method comprising:

selecting a control volume within the exhaust system; and

using a model derived from a transient energy balance equation for the control volume to determining the rate for fuel to be dispensed into the exhaust stream.

2. The method of claim 1, wherein the control volume includes a catalytic converter, wherein the catalytic converter is positioned upstream from a diesel particulate filter, wherein the fuel is dispensed upstream of the catalytic converter, and wherein rate for dispensing the fuel is selected to achieve a temperature at a downstream end of the catalytic converter that is suitable for causing regeneration of the diesel particulate filter without causing the diesel particulate filter to overheat.

3. The method of claim 1, wherein the exhaust system includes a catalytic converter positioned upstream from a diesel particulate filter and a fuel dispensing nozzle positioned upstream from the catalytic converter, and wherein the control volume starts upstream from the fuel dispensing nozzle and ends at the downstream end of the catalytic converter.

4. The method of claim 1, further comprising accessing pressure, temperature and mass flow data for the exhaust system, and using the data in concert with the model to determine the rate of fuel to be injected.

5. The method of claim 1, wherein the exhaust system includes a catalytic converter positioned upstream from a diesel particulate filter and a fuel injector positioned upstream from the catalytic converter, wherein temperature and pressure data are sensed upstream of the fuel injector and downstream of the catalytic converter, and wherein the temperature and pressure data are used in concert with

the model to determine a fuel injection rate suitable to reach a temperature at the downstream end of the catalytic converter that is within a target temperature range.

6. The method of claim 2, wherein the model takes into consideration the vaporization efficiency of the fuel.

7. The method of claim 2, wherein the model takes into consideration the fuel conversion efficiency of the catalytic converter.

8. The method of claim 2, wherein the model takes into consideration the thermal energy storage rate of the catalytic converter.

9. The method of claim 2, wherein the model takes into consideration mass flow through the control volume.

10. The method of claim 2, wherein the transient energy balance equation is used to calculate a mean temperature of the catalytic converter, and wherein the mean temperature of the catalytic converter is used as a variable in the model.

11. The method of claim 10, wherein the fuel conversion efficiency of the catalytic converter is used as a variable in the model.

12. The method of claim 2, wherein the model uses the mean temperature of the catalytic converter as a parameter.

13. An exhaust system comprising:

an exhaust conduit;

a reactant injector;

a housing positioned outside the exhaust conduit for housing the reactant injector, the housing defining an air line port and a reactant line port, the housing also defining a pre-mix region into which the reactant injector injects reactant;

a reactant line coupled to the reactant line port of the housing for providing reactant to the reactant injector;

an air line coupled to the air line port of the housing for providing compressed air to the pre-mix region, the reactant from the injector and the air from the air line being mixed at the pre-mix region to form a reactant/air mixture;

a nozzle for spraying the reactant/air mixture into the exhaust conduit; and a mixed reactant/air conduit for conveying the reactant/air mixture from the pre-mix region of the housing to the nozzle.

14. The exhaust system of claim 13, further comprising a catalytic converter and a diesel particulate filter positioned within the exhaust conduit, the catalytic converter being positioned upstream of the diesel particulate filter and the nozzle being positioned upstream from the catalytic converter.

15. The exhaust system of claim 13, wherein the nozzle is positioned upstream from a lean NOx catalyst.

16. The exhaust system of claim 13, wherein the nozzle is positioned upstream from a NOx absorber.

17. The exhaust system of claim 13, wherein the pressure of the reactant supplied to the reactant injector is 40 to 100 pounds per square inch.

18. The exhaust system of claim 13, wherein the pressure of the air supplied to the pre-mix region is 10 to 50 pounds per square inch.

19. The exhaust system of claim 13, wherein the pressure of the reactant supplied to the reactant injector is 30 to 50 pounds per square inch greater than the pressure of the air supplied to the pre-mix region.

20. The exhaust system of claim 13, further comprising a pump for supplying pressurized reactant to the reactant line.

21. The exhaust system of claim 13, further comprising an air tank in fluid communication with the air line.

22. The exhaust system of claim 13, further comprising an air pressure regulator in fluid communication with the air line for regulating the pressure of the air within the air line.

23. The exhaust system of claim 13, further comprising a solenoid valve in fluid communication with the air line for controlling the flow of air within the air line.

24. The exhaust system of claim 13, wherein the reactant comprises fuel, and the reactant injector comprises a fuel injector.

25. The exhaust system of claim 13, wherein the housing includes a first block and a second block between which the reactant injector is mounted.

26. A method for introducing a reactant into the exhaust stream of a vehicle exhaust system, the vehicle exhaust system including a substrate, the method comprising:

determining the mean temperature of the substrate; and

using the mean temperature of the substrate as a parameter for controlling the introduction of the reactant into the exhaust stream.

27. The method of claim 26, wherein the substrate is catalyzed to promote a reaction of the reactant at the substrate.

28. The method of claim 27, wherein the reactant includes a hydrocarbon fuel, and wherein the hydrocarbon fuel is injected into the exhaust stream at a location upstream from the substrate.

29. The method of claim 28, wherein the substrate comprises a diesel oxidation catalyst.

30. The method of claim 28, wherein the substrate comprises a lean NOx catalyst.

31. The method of claim 28, wherein the substrate comprises a NOx trap.

32. The method of claim 26, wherein a mathematical model is used to control the injection of reactant into the exhaust stream, the model including the mean temperature of the substrate as a variable.

33. The method of claim 26, wherein the reactant is injected into the exhaust stream at a location upstream from the substrate.